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ABSTRACT

Noting that accurate procedures for predicting reading ability in school settings are necessary for a variety of purposes, this paper reviews methods for predicting reading ability and presents a new, more precise model for use at the second grade level. First, the paper defines reading expectancy as an informed estimate of the level of reading achievement that can realistically be expected of an individual when the relevant facts are known. Presented next is a historical review of reading expectancy formulas from the late 1920s to the present. The review notes that many of the formulas grew more complex and began to test different aspects of reading, such as listening comprehension, while others relied on general intelligence testing to predict reading ability. After pointing out the difficulty these models have in predicting actual achievement for individual children, the paper proposes a multiple regression model that makes use of stepwise regression analyses to test second grade native speakers of English. Correlates of reading achievement that the proposed model must account for are the topic of the next section, which discusses intelligence tests, listening comprehension tests, anxiety, attention span, self-esteem, socioeconomic status, and sex variables. Twelve tests for these variables for inclusion in a proposed reading diagnosis battery are then listed, followed by three research hypotheses and a graph of the proposed reading expectancy model. The document concludes with 67 references. (SKC)

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A MODEL FOR THE DEVELOPMENT OF A READING EXPECTANCY FORMULA

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Introduction

Accurate procedures for predicting reading ability are necessary for a variety of purposes "such as 1) to arrange a number of children in order of severity of reading disability, 2) to determine eligibility for inclusion in a remedial program, 3) to make statistical studies of the frequency of occurrence of reading disability, 4) to match groups of disabled readers for experimental purposes, and 5) to determine the need for remedial personnel in a school system."[1] This paper will review the methods for prediction which educators refer to as reading expectancy formulae, and will present a new model with which a more precise equation might be formulated.

Definition

Reading expectancy is "an informed estimate of the level of reading achievement that can realistically be expected of an individual when the relevant facts are known."[2]

Historical Review

Classroom teachers and clinicians have always sought to establish the criterion against which reading disability could be defined. Failure to make such a determination resulted in the assignment of many pupils to

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[1]Albert J. Harris, How to Increase Reading Ability (New York, David McKay Company, 1970), p. 209.

[2]Albert Harris and Edward Sipay, How to Increase Reading Ability, Sixth Edition., (New York, David McKay Company, 1975), p. 147.

remedial reading classes who could not profit from such instruction because of restricted learning abilities. A simple solution to this dilemma was to express the adage that reading retardation occurred when a child's achievement was below his potential. If only a measure of capacity could be developed, it was felt, the explanation would be validated. The apparent panacea made its appearance in the first decade of the present century in the form of Binet's intelligence scale.

In 1929 Thorndike and Gates proposed the use of the Accomplishment Quotient (reading age) / (mental age) "to make it possible to reveal not only absolute achievement along any line, but also attainment in proportion to capacity of the individual for productivity in that line."[3] Teachers were able to gauge their own efficiency, as well as the child's, by their success in keeping the quotient of all pupils close to 100 percent.

The theoretical validity of the Accomplishment Quotient has now been rejected (Vernon, 1958). It assumes that a child's reading achievement cannot exceed his measured intelligence level. Evidence to the contrary sits under teachers' noses everyday.

Marion Monroe (1932) formulated a more complex theory of estimating reading expectancy. In Children Who Cannot Read she suggests an "index" of reading expectancy, using chronological grade, mental grade, and arithmetic computation grade. The average of these three factors would indicate the level at which the child should be able to read. His reading grade, obtained from the average of an oral reading test, a

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[3] Ed Thorndike and Arthur Gates, Elementary Principles of Education (New York, MacMillan, 1929), p. 227.

silent reading test, a word recognition test, and a word discrimination test, divided by the expectancy grade, would be the Reading Index.

In research on 415 children with special defects in personality and reading, and a control group of 101 average American school children, the following facts were noted and conclusions made. In the average school children group the chronological age correlated with reading age in a normal distribution about the mean; however, in the defective group, all were far below their chronological age in achievement. If chronological age were the only consideration, all of the defective group would be diagnosed as retarded readers.

Those who had a mental age above their chronological age surpassed their chronological age but did not reach mental age standards in reading. The defectives showed greater discrepancies in regard to achieving up to their mental age. Monroe feels that the combination of mental age and chronological age is more logical and realistic than either factor alone. She notes that mental age is especially unfair to the young, bright child who has not had the educational opportunity to learn to read.

In order to identify reading as a special retardation, and not a result of absence from school, or a general emotional or educational problem, she advocates comparing reading achievement with another school subject. She chose as the third factor in her formula, the score obtained on the Stanford Achievement Test in Arithmetic Computation, which requires minimal reading.

In computing the scores of the experimental groups according to the formula the control group had a mean index of 1.02. The mean index of the defective group was .49, 2.75 standard deviations below the mean of the control group. Monroe concluded that children with a reading index of less than .80 needed correctional work while those in the 80 to 90 range were borderline cases.

Even though Monroe's work was completed 44 years ago, it represents one of the most ambitious and well planned studies of expectancy. In the final phase of her research a group of reading disabled children were selected for remedial instruction using the expectancy formula. When the remedial program concluded Monroe suggested that personality and behavior would be fruitful areas for additional study and should be included in future expectancy formulae.

As the result of extensive research in the Los Angeles City Schools, Alice Horn (1941) found that bright children tend to achieve in reading and arithmetic below the level predicted by their mental age, while dull children frequently achieve above their mental age. She developed a series of formulae which use chronological age to temper mental age. Torgerson and Adams, in explaining Horn's theory, argue that an eight year old with an I.Q. of 150 (M.A. 12) would not be expected to achieve at the level of an average twelve year old. Similarly, an eight year old with a mental age of six would achieve above the six year old's level because he has had experiences and opportunities the average six year old has not . As the first to use regression techniques, she concluded that chronological age is a very important factor in social, emotional, and motor maturity at the primary level and weighed chronological age and mental age equally when predicting achievement from 6.0 to 8.5

years: $\frac{C.A. + M.A.}{2}$ = X.A. (expected achievement). In higher elementary grades, the mental age is more important than chronological age in predicting achievement. From 8.6 to 9.11, the formula is $X.A = \frac{3M.A. + 2C.A.;}{5}$ for ages 10.0 to 11.11, the formula is $\frac{2M.A. + C.A.;}{3}$ and for age twelve and above: $\frac{3M.A. + C.A.}{4}$. Using the child's chronological age and the child's intelligence quotient translated into mental age, the expected achievement age can be computed for reading and arithmetic.

Horn's formulae have the advantage of using a regression procedure which provides different factor weightings for four age groups. However, the formulae were contructed to predict reading and arithmetic achievement, so the result is a compromise. If an educator's concern is solely with reading achievement, a stricter approach is desirable.

Donald D. Durrell and Helen Blair Sullivan (1945) advocated the use of listening comprehension as a guide for computing reading expectancy. Conducting studies on more than 2,000 reading disability cases, they concluded that serious cases of reading disability can be discovered by finding the discrepancy between the child's understanding of spoken language, and his understanding of the printed word.

The Durrell-Sullivan Reading Capacity Test is composed of two sections. In the first section the examiner pronounces a word and the child finds an appropriate illustration. The words were graded according to the Gates Primary reading list and the Durrell word list. An additional consideration was the selection of words which could be adequately illustrated.

The paragraphs in the second section were carefully graded according to vocabulary, sentence structure, and conceptual sophistication. An effort was made to use interesting factual and informational material so that comprehension, not interest or attentiveness, would be measured. Comprehension questions were phrased in words other than those used in the paragraph so that they would measure understanding rather than verbatum memory.

The reading capacity score is compared to the Durrell-Sullivan Achievement Test score to ascertain the discrepancy between achievement and listening comprehension. This discrepancy theoretically indicates retardation. The tests were standardized on the same population. The results showed that 15% of the children would seem to be retarded by an amount equal to one grade level. Durrell recognized that the entire difference could not be ascribed to difficulty in reading. However, he states: "... a very sizable proportion of the differences found will in most cases be due to reading difficulty, and . . . there will be relatively few cases . . . which will not be discovered by use of these tests."[4]

Durrell and Sullivan use listening comprehension as a single predictor of reading expectancy. Two cautions are in order: 1) In tests of listening comprehension it has been shown that listening is a skill in itself, and can be improved by training (McLeod, 1968). If listening comprehension has not developed spontaneously or by training, then listening capacity tests might not identify the retarded reader who is

[4]Donald Durrell and Helen Sullivan, Reading Capacity and Achievement Tests Manual, (New York, Word Book Company, 1945), p. 10.

also a retarded listener. 2) The rather high percentage of discrepancy in the Durrell-Sullivan Capacity and Achievement Test performances may be due to the type of responses demanded on the latter. The score is based on recognition, rather than recall. Recognition responses might tend to give spuriously high scores, since they do not demand as high a degree of comprehension as do recall responses.

Cleland (1953) proposed an expectancy score based upon the average of arithmetic age, mental age, chronological age, and listening comprehension age. For some unknown reason, this formula did not enjoy widespread acceptance.

Utilizing the principle time multiplied by rate equals distance, Guy L. Bond (1957) and his colleagues proposed a reading expectancy formula (years in school x I.Q.) + 1.0 = Reading Expectancy. In research among 379 fifth grade students expectancies were computed upon the Bond formula and also using the mental grade as the only criterion for expectancy. The Stanford-Binet individual intelligence test provided the I.Q. score, and the Gates Reading Survey was used to evaluate reading achievement. The Bond Formula gave estimates of reading expectancy reported as "startlingly close to the actual reading averages for almost every level of I.Q. "[5]

Bond states that able children should not be expected to achieve what mental age alone predicts. He contends that his formula allows for the necessary effect of educational opportunity. The bright pre-schooler is not expected to read at all since his years in school would be 0 and

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[5]Guy L. Bond and Miles A. Tinker, Reading Difficulties, Their Diagnosis and Correction (New York, Appleton-Century-Crofts, Inc., 1957), p. 79.

and the ten year old child with 150 I.Q. would not be expected to read at the level of the fifteen year old with average ability.

Bond maintains that the mental grade method is unrealistic when compared to observed reading scores. The mental grade method approximates actual reading achievement only for average children in the 90-110 I.Q. range.

Reading is a skill which is usually taught. Bond and Tinker included this variable in their formula by including a "years in school" factor, but difficulties still remain. Their formula ignores the effect of high or low intelligence during the six years before first grade instruction, with the effect that all children who enter first grade are considered on a par and ready for beginning instruction with expectancies of 1.0. Bright children in particular may come to school more prepared due to informal or formal instruction and learning. Years in school would be inoperable in certain cases; where the child has repeated a grade, he has not gained two years of schooling because the work was probably merely repeated; if the teaching methods have been ineffective or the teacher incompetent, the year would not have full value; in the case of lower I.Q. children, they may not have been mentally ready for instruction at the time it was presented, and therefore could not be expected to benefit from it. Rodenborn (1974) has shown that the Bond-Tinker formula tends to overestimate the ability of low I.Q. children while under-estimating the capacity of bright children. Additionally, the Bond-Tinker formula assumes that the same correlation between intelligence and reading exists at all grade levels. A serious problem with their research was that they only dealt with fifth grade students.

Albert Harris (1961) recommended that mental age, as measured by an intelligence test which requires no reading, be used as the basis for determining reading expectancy. He believed that intelligence and reading capacity were equivalent, a view which turned the clock back to the turn of the century. He states, "The formula is simple . . . mental age minus reading age sets expectancies in terms of the ideal of each child's functioning in reading in accordance with his general level of mental development."[6] The larger the difference between the two scores, the greater the degree of retardation in reading. Many people were attracted to the simplicity of Harris's formula and it continues to enjoy great popularity.

Harris implies that very bright children seldom reach their maximum expectancy because of lack of challenge. Dull children may overachieve because of teacher or parental pressure, but he questions the value of forcing dull children to reading achievement above their general levels of functioning. In disallowing the use of educational opportunity or years in school as a factor in expectancy, he points out that an eight year old child in second grade whose I.Q. is 75, and therefore has a mental age of six, has barely the mental age many consider necessary for systematic instruction in reading. Consequently, he should not be penalized for his years in school.

Donald Cleland and Isabella Toussaint (1962) developed a multiple regression equation for predicting reading achievement in grades four, five, and six. Reading achievement was measured by the Gates Reading

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[6]Albert J. Harris, How to Increase Reading Ability, (New York, David McKay Co., 1961), p. 300.

Survey-Form 2. The equation was: Y = .983 (Sequential Test of Educational Progress-Listening 4A) + .847 (American School Achievement, Form G, Part II, Arithmetic Computation) + .499 (SRA Primary Mental Abilities, Form AH) - 56.07.

A fresh approach to reading expectancy was introduced in 1968 by John McLeod. He makes it clear that the measurement of capacity is elusive and that his concern is the prediction of reading achievement. McLeod suggests a Predicted Reading Quotient = 100 (1-r) + r(.I.Q.), where r is the correlation between reading achievement and intelligence. The use of the correlation coefficient is intended to make the result more precise by indicating that achievement and intelligence do not correspond completely. To further offset spurious statistical effects, which are found in the strict mental age method, a 95 percent confidence interval based on the standard error of an individual score ($SD\sqrt{1-r}$) was incorporated. Unfortunately, McLeod assumes that the correlation between mental age and reading is the same at all grade levels, a value he does not mention. While McLeod offers a mathematical model, it must be noted that he places greater faith in the careful observation of individual cases by trained personnel.

The fifth edition (1970) of Albert Harris's How to Increase Reading Ability includes a revision of his preference for a reading expectancy formula. While citing Bond and Dykstra's 1967 work which showed the changing correlations between mental ability and reading comprehension as grade level increased, he promptly ignores it and recommends one of Horn's formulas (2MA + CA /3) for use with all age groups. This formula gives essentially the same results as those obtained from using a simple

regression equation for predicting reading age from mental age alone, assuming an average correlation of .67. Two additional calculations, a Reading Expectancy Quotient and a Reading Quotient are necessary to determine the degree of disability.

Alspaugh and Burge (1972) suggest that reading expectancy be defined in terms of a least squares regression line, $Y_e=bx + a$, computed for each grade level in each school using the students' I.Q. scores and reading achievement scores. Where x is the student's I.Q. score and Y is reading achievement score, a student's reading expectancy is the Y_e (predicted achievement) corresponding to his I.Q. Hence a student is a disabled reader if his reading achievement, Y, is less than his reading expectancy Y_e, by some predetermined amount. An alternative would be to classify a student as disabled if a specified percent of the students have a higher level of reading achievement after factoring out differences due to I.Q. Using a criterion of 90 percent, the corresponding z-value is 1.28. Thus a student with reading achievement, Y, less than $Y_e - 1.28\ (S_{y.x})$ would be classified as a disabled reader. This approach is interesting but not entirely satisfactory since it relies exclusively on the factor of intelligence.

The primary purpose of a Marshall and Powers investigation (1973) was to determine and cross-validate regression equations for predicting Iowa Test of Basic Skills achievement test scores for students in grades five through eight. The independent variables were 1) pre-achievement scores from the Iowa Test of Basic Skills, 2) I.Q. based on the Lorge-Thorndike, 3) sex, 4) school mobility, 5) Aid for Dependent Children (received or not), 6) chronological age, 7) race, 8) years in school, and, 9) learning rate.

The cross-validation samples are of interest to this report since they compared the predicted achievement to the actual achievement.

The regression equations were validated using non-overlapping samples of students drawn from the same populations as the original data producing samples. The cross-validation samples consisted of 1680, 1620, 1680, and 1432 students from grades five through eight respectively.

The first set of analyses was the determination of the correlations between predicted and actual scores and the standard errors of estimate. The results of these analyses show the cross-validation correlations to be about as high as the original ones. In five instances the correlations were equal to or higher than those originally obtained. Even though the correlations were relatively high, considerable error was present in individual predictions. Most of the standard errors were in the .80's and .90's. Thus the 68% confidence interval would have a range of over 1.5 grade equivalents.

Table I lists some of the obtained equations. It is essential to note that previous achievement was the most important factor in each of the formulae. This is, of course, to be expected. In the ideal expectancy formula, however, the predictors should be independent of the criterion (reading) so that poor readers are not penalized.

Table I

Grade	Test
5	ITBS Vocabulary=.6313(voc$_1$)+.02761(IQ)-.00375(ADC)-.20406(sex)+.18109
	ITBS Reading=.53769(reading$_1$)+.02771(IQ)-.00294(ADC)+.50885
6	ITBS Vocabulary=.62483(voc$_1$)-.00498(ADC)+.03039(IQ)-.25166(sex)+.04537
	ITBS Reading=.58858(reading$_1$)+.03126(IQ)-.00265(ADC)+.04957

The ideal method for computing reading expectancy has clearly not yet been created. For example, the available formulae do not yield identical results for the same children, particularly for children at the extreme ends of the intellectual continuum (McLeod, 1968; Rodenborn, 1974; Simmons and Shapiro, 1968; Ullmann, 1969; Heydenberk, 1971). This reflects the imprecission of the approaches, as well as the varying selection and definition of criterion and correlates.

Proposed Model

A multiple regression model holds the most promise in the pursuit of a measure of expectancy. The regression technique is based upon the relationships between two or more predictors and a measure of achievement within particular populations. Multiple regression has an advantage over general expectancy formulae as it maximizes the relationship between expectancy predictions and measures of achievement, and it attenuates errors of measurement by insuring that they are uncorrelated with either the predictor or criterion measures. One simple caveat should be considered in using the regression approach to establish achievement expectancies: variables should be selected for possible inclusion into prediction equations which minimize potential content overlap between the predictors and the achievement measures. This poses a dilemma for people in search of effective survey techniques. As Thorndike has noted, "We need a measure of potential that bears some substantial relationship to our index of achievement. However, the measure of potential should not include within itself any of the specific components of the achievement measure."[7] This is a particularly important

[7] Robert Thorndike, The Concepts of Over and Under Achievement, (New York, Teachers College Press, 1963), p.52.

consideration in using intelligence tests involving reading as measures of expected achievement. Well-validated empirical findings show that underachievers do poorly on most verbal measures of intelligence.

Stepwise regression analyses will be necessary to identify those variables which make the most significant contribution and to find out to what extent the prediction of observed reading scores could be improved by the use of multiple rather than single factors. In the final predictive equation each of the selected predictors is weighted according to its relative contribution to the explained portion of the variance of the criterion test. Regression analysis permits the conversion of individual test scores to reflect the contribution of each test to reading. The sum of these single scores is the total battery score.

The possible factors which could be investigated are multitudinous. Certain practical suggestions for examination are discussed below. There will be no attempt to deal with the physiological or instructional research (ex. pre-natal insult, severe illness, improper match between students and approaches). Also, the exclusion of two additional factors, a teacher's judgments regarding achievement and an indicator that reading is a special rather than general learning problem, should be explained. It is felt that the addition of teacher predictions would be similar to considering previous reading achievement, since the judgement would likely be based on cumulative records of past reading achievement, informal reading inventories and classroom performance. Therefore, the teacher's expectations of a poor reader may be unfairly low. Next, arithmetic is usually chosen to indicate whether the child's

learning difficulty is general or specific. Arithmetic tests involve the decoding of symbols, a reading process, and employ reading directly if story problems are included. Since these tests entail reading or a form of it, they put poor readers at a disadvantage. Another measure could be chosen, but it is not necessary. The importance of both factors is not to be belittled, but the benefits of using subjective judgments in both regards to interpret the expectancy score outweigh the advantages of employing them directly in the regression equation.

The proposed model is intended for use only at the second grade level with students who do not speak a foreign language, and who have not been promoted or retained. Second grade was chosen so that early detection of reading problems could occur, and in an effort to help standardize research in this area by using the same age group as the Jansky and Dehirsch (1972) research. It is felt that alternative definitions for achievement and the essential correlates would be necessary if another grade level were selected for study. Furthermore, it is proposed that a multiple regression line be plotted at each school. This would help to temper the influence of teacher competence, curriculum, methodology, years in school, chronological age, and other unique characteristics. District norms should not be established if the schools are significantly heterogeneous in regard to the factors included in the regression equation. Certainly, national trends would be extremely difficult to establish. This approach will require a tremendous expenditure of time, effort, and funds which schools must weigh against their concern for accuracy. The recommendation is theoretically appropriate, not practical.

To classify students as disabled readers, an arbitrary criterion of 90 percent should be established. Thus, a student with reading achievement, Y, less than $Y_e - z_{.90}$ (standard error) would be classified as a disabled reader. The criterion could easily be altered to be more or less restrictive as desired.

Examination of critical reviews of tests in a source such as The Mental Measurements Yearbook reveals that standardized tests vary greatly in the scope of skills and abilities measured, in specific aspects of their construction, in standardization related to their validity and reliability, and in the specific survey or diagnostic purposes for which they were designed. For these reasons the selection of tests below is largely a matter of judgment. That judgment reflects the tests' validity, reliability, its appropriateness for use with second graders, and its popularity in past research.

The studies that are included in the proceeding discussion share certain common characteristics which must be borne in mind. First, the selected research has been limited to works which deal with the elementary grades. Next, the studies use normal populations rather than selective subjects, except in an few studies which are unusually pertinent to the discussion. Finally, literature which describes predictive relationships are not included. Only studies that administered their measures concurrently are included.

Correlates of Reading Achievement

Intelligence Quotient

Intellectual correlates of reading have been studied for many years. Among school populations there is a substantial positive correlation between intelligence and reading achievement tests. Gray (1960) reported

that correlations between intelligence and reading achievement tests tend to cluster between .40 and .60. Correlations are generally in the .40's and .50's in the first grade and increase steadily with grade level. In all of the regression equations discussed in the historical review intelligence accounted for the greatest part of the reading variance. Some of the various intelligence tests which have been correlated with the reading ability of elementary school students are the Pintner General Ability Test (Lennon, 1950), Stanford-Binet Intelligence Tests (Goodenough, 1925), and the Wechsler Intelligence Scale for Children (Reid, 1966; Triggs and others, 1954).

Wide differences are frequently obtained from different intelligence tests. Extreme caution should be exercised in the use of these scores. In an interesting study by Miller (1973) The Peabody Picture Vocabulary Test, The Slosson Intelligence Test, and the Lorge-Thorndike were administered to the same group of students. Twenty-seven percent of the sample obtained scores which varied as much as 20 I.Q. points among the tests. Several of the subjects obtained scores which varied as many as 30 I.Q. points. One can readily see that when these scores are used in expectancy formulae quite different outcomes are obtained.

The selection of the most suitable test for use with expectancy formulae must be pursued. Verbal group mental tests are of little use in selecting children who will profit the most from remedial instruction. These tests are to a great extent reading tests and a poor reader cannot demonstrate his true mental ability if he cannot read the questions (Gunderson, 1960). As Wilson observes, "Unless group intelligence tests have non-language features, they are not particularly useful in estimating

the reading potential of children with reading problems."[8] Yet, verbal mental tests cannot be dismissed since they correlate more highly with reading than do non-verbal mental tests (Downing, 1965). A solution to this dilemma is to use the WISC, an individually administered test which provides a full-scale score comprised of verbal and non-verbal scores. This popular test gives an accurate measure of mental ability for able readers and is only slightly affected by the lack of reading ability of disabled readers.

Some attempts have been made to determine if specific aspects of intelligence may be more highly correlated with reading achievement than others. Dore-Boyce, Misner, and McGuire (1975), among others, feel that a breakdown of intelligence would improve multiple regression equations. Bond and Clymer (1955), for example, investigated the possibility of the greater correlation between reading achievement and some specific aspects of intelligence than between it and others, showing that for a normal population verbal and reasoning subtest scores in the Primary Mental Abilities Test were significantly related to reading achievement but that the space and number subtest scores were not. The Illinois Test of Psycholinguistic Abilities also posits hope for future research to those who believe it measures cognitive functions. These efforts and attempts to isolate those subtests of the WISC which correlate most highly with aspects of reading achievement (McLeod, 1965;

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[8] Robert Wilson, Diagnosis and Remedial Reading for Classroom and Clinic (Columbus, Ohio, Merrill, 1967), p. 35.

Hafner and others, 1970) provide high expectations which hopefully will be met when future research is able to offer greater clarification.

Listening Comprehension

Listening comprehension is a good indicator of the level of understanding of language and ideas. Measures of listening comprehension primarily appraise language acquisition, the knowledge of the same words and sentences which appear later in reading. Listening comprehension tests also correlate highly with intelligence while eliminating the influence of failure to interpret symbols.

Even though educators such as Hilliard (1924), Hildreth (1935) and Young (1936) pointed out that poor language comprehension appeared to contribute significantly to reading disability, very little research emerged to substantiate the theory until the 1940's. In research cited previously (Durrell and Sullivan, 1945; Cleland, 1953; Cleland and Toussaint, 1962) listening ability was found to be substantially correlated with reading achievement throughout the elementary grades. Cleland and Toussaint were especially impressed with the importance of listening to reading and suggested "that greater emphasis should be placed on the teaching of listening, especially at the intermediate grade level."[9] Markert (1975, second graders) also showed that there is an intimate relationship between reading and listening. He believed that supposed reading difficulties often turn out to be language deficiencies.

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[9]Don Cleland and Isabella Toussaint, "The Interrelationship of Reading, Listening, Arithmetic Computation, and Intelligence," Reading Teacher, January 1962, p. 230.

Further evidence of the strong relationship between language and reading was offered by Zeman (1969) who found that better readers in grades two and three, as measured by the use of the comprehension section of the SRA Achievement Series in Reading, exhibited more complex sentence patterns in writing.

Two popular tests for measuring listening comprehension are the Durrell-Sullivan Reading Capacity Test and the Sequential Test of Educational Progress-Listening 4A. It is proposed that the STEP Listening test be included in the current model since it shows a closer relationship with reading achievement than does the Durrell-Sullivan test (Cleland and Toussaint, 1962).

Anxiety

Anxiety is among the more important personality variables examined by researchers. People measured as highly anxious have been shown to perceive more intense threat in a greater variety of circumstances. It appears that anxiety is a response to stress or to the perception of threat. When experienced at an optimal level for the subject, such anxiety facilitates problem solving behavior and achievement,but at an intense level it exerts a disorganizing effect, diminishing the powers of discrimination and thinking.

Scarborough and others (1961) noted a significant relationship among 162 pupils in grade six between three levels of anxiety on the Children's Manifest Anxiety Scale and measures of reading and language achievement. They concluded that there was a significant relationship between anxiety level, reading, and language performance for all students and particularly for students of average and high intellectual ability.

That pupil anxiety as measured by the Taylor Anxiety Scale is significantly related to school structuring of reading method (structured=phonics versus unstructured=whole-word recognition approach) was confirmed for 228 pupils in grade three by Grimes and Allinsmith (1961). This study is of particular interest in that it showed the high achievement of highly anxious and compulsive children in a structured setting, their significantly lower relative achievement in an unstructured setting, and the resulting underachievement when their high anxiety was combined with low compulsivity in the latter setting.

It is proposed that both the Children's Manifest Anxiety Scale and Sarason's (1958) Test Anxiety Scale for Children be given. The former test primarily measures the level of total effective drive, and it is a modified version of the Taylor Anxiety Scale revised especially for use in the elementary grades (Castaneda and others, 1956). One modification is in order. The test should be administered verbally rather than being read by the student. The Sarason test has frequently been employed in studies because of its usefulness in measuring attitudes toward and experiences in test and test-like situations.

Attention

"Ability to attend and concentrate means that the person can maintain focus on particular stimuli and disregard or surpress other stimulation that reaches him at the same time, thus maintaining a stable figure in the focus of attention, against a noninterfering background."[10] Failure to learn may be due to inattention rather than to the lack of basic skills.

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[10] Albert Harris and Edward Sipay, How to Increase Reading Ability, (New York, David McKay Company, 1975), p. 256.

Denny (1974) found substantial differences between good and poor readers based upon the Gates-McKillop Reading Test and the Gilmore Oral Reading Test along the attentional style dimension. Attentional style refers to the child's ability to deploy his attention selectively, thereby avoiding distraction from intrusive and irrelevant stimulus information. This study and Santostefano and others (1965) point out the necessity of assessing attentional deployment in the face of distracting information both embedded within the relevant stimuli (e.g., silent letters) or in close proximity to them (e.g., pictures).

The task of assessing attentional deployment to the fine degree that Denny recommends is an extremely difficult assignment. Schultz (1973) suggests that more overt and general behavior can be used to measure attention. She found correlations of .43 for boys and .58 for girls between reading achievement and attention as judged by the Jackson-Hudgins Observation Schedule (1965).

The Jackson-Hudgins schedule should be explained here since it is outlined only in an unpublished manuscript. The schedule, which measures the student's degree of attention to relevant classroom activities, is kept on coding sheets which alphabetically list first the boys' names and second the girls'. Ten columns follow the list of names. Different coding sheets are used whenever there is a change in the unit observed or the area of focus. The attention of each student is recorded by looking at each pupil in turn and marking on his row in the appropriate column one of the following: "+" if the

pupil is attentive, attending to both the area of focus and the prescribed activity; "-" if the pupil is inattentive, not attending to the area of focus and/or the prescribed activity; "?" if it is not known whether the pupil is attentive or not, insufficient clues to determine the focus of his involvement; "o" if the pupil is out of the room or out of his seat at the moment of recording.

Each column on the sheet represents a "sweep" which is defined by the authors as the scanning of the total group being observed. The attention scores are presented as percentages.

The authors state that a general rule for judging attention is to take the stance of the teacher. A list of specific clues to look for in judging attention is also included. The clues fall under the headings of postural, body movements, facial expressions, and other, such as having a book open to the appropriate page, and reciting.

It is proposed that the Jackson-Hudgins Observation Schedule be included in the model.

Self-Esteem

In general, high and low achievers vary in terms of their dependency, sense of security, and social maturity. These personality factors mentioned above affect and are affected by a student's academic confidence and his feelings of self-worth. For example, Kim (1968) studied a group of second graders and reported significant differences between high and low achievers in academic factors associated with social maturity. These reported differences were over and above differences in chronological age, IQ, and performance on standardized tests.

Using the Gordon Self-Concept Inventory and the Gates-MacGinitie Reading Tests, Devito (1974) found a correlation of .37 for boys and .32 for girls between the two measures in grades three through six. Swartz (1972) found a mean correlation of .35 for third graders between the total self-esteem scores on the Self-Esteem Inventory and the instructional reading level as determined by an informal reading inventory. This correlation was significant at the .01 level which supports the hypothesis that instructional reading level is positively related to self-esteem.

It is proposed that the Gordon Self-Concept Inventory be included in the model.

Socioeconomic Status

The findings of studies which examine socioeconomic status are unusually consistant. These studies (Rohwer, 1971; Jantz, 1974; Jansky and DeHirsch, 1972) report that students ranked highly in socioeconomic status outperform students of low socioeconomic status. The usual indicators of socioeconomic status (parental educational attainment, income, and occupation) are crude statements which embody a complex set of cultural factors. It is hoped that future research will be able to identify the most essential variables involved.

A minor component of Jansky and DeHirsch's classic predictive study investigated the concurrent relationship between certain background variables and second grade reading achievement. An interesting result was the correlation between socioeconomic status and reading of .49. This correlation was only lower than the coefficient expressed for a subtest of the WISC.

Jansky and DeHirsch defined socioeconomic status on a four point scale which considered parental educational attainment, occupation, and total family income. Marshall and Powers, cited previously, dichotomized socioeconomic status into receipt or non-receipt of Aid for Dependent Children. A preferable definition is used in the study by Jantz (1974). Socioeconomic status was determined by the occupational ranking on the National Opinion Research Center's Occupational Prestige Scale (Hodge, 1966). Three powerful benefits of this definition should be noted: 1) it provides numerous graduations, 2) it is based on 36 years of research which make its categories less subject to minor economic and social changes, and, 3) since it is based on opinion, the social power which affects how one sees himself and his family is of considerable consequence.

Sex

In a study of over 13,000 students in grades two through eight, Gates (1961) found the mean raw scores for girls higher than that for boys on 21 comparisons of the Gates Reading Survey Tests. In addition, a relatively large proportion of boys obtained the lowest scores without a corresponding increase in the number obtaining top scores. Wozencraft (1963) noted for 364 pupils in grade three that sex differences significantly favored girls.

Evidence from USOE First Grade Studies (1967) also indicate sex differences in reading. It was generally found that mean scores were in favor of girls on readiness measures, first grade achievement tests, and on tests given to the groups that continued the experiment through second grade. Another large scale study, the recent National

Assessment of Educational Progress (1972) reported that girls did better than boys on all reading skills at three school ages.

Loughlin and others (1965), in an attempt to discover the relationships between anxiety and achievement among elementary school children, studied the differences between the sexes by intelligence, subject matter, grade, and achievement level. The entire population of grades four through eight in an urban-suburban school district was given a series of tests including the California Reading Tests. In general, the results confirm the hypothesis that girls generally attain higher mean anxiety scores than do boys. Such findings "suggest that sex differences in anxiety manifest themselves early in children's academic careers, reach a peak in the fifth or sixth grade, ..."[11]

Another aspect influenced by factors in the environment, and favoring girls, is language development. Numerous studies have found girls to develop speech ahead of boys, to articulate more clearly, to use sentences ahead of boys, to use less slang, and to have a larger vocabulary (McCarthy, 1953; McCarthy, 1954; Moore, 1960; Stanchfield, 1965). In general, girls develop language competence at a faster rate than boys especially when IQ and socioeconomic status are held constant.

Sex differences may indeed largely be due to environmental influences, but they must be included in this model due to their pronounced effect at the second grade level.

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[11] L.J. Loughlin and others, "An Investigation of Sex Differences by Intelligence, Subject-Matter Area, Grade, and Achievement Level on Three Anxiety Scales," Journal of Genetic Psychology, 106 (1965), p. 214.

Criterion: Reading Achievement Battery

Since success in reading is related to different correlates at various stages of the reading task, it is imperative to establish as a criterion instruments which correlate with a definition of early reading--that is, decoding, and word identification and analysis--rather than mature reading. Early reading, which is typically experienced in second grade, is primarily concerned with skills which may be necessary antecedents of mature reading.

The tests in the proposed battery are taken directly from Jansky and DeHirsch for three reasons: 1) the definition of reading in the second grade is comprehensive, 2) this report is in agreement with the definition, and, 3) the utilization of the definition will serve as an attempp to standardize research in the area.

All tests are to be administered individually except the silent reading and spelling tests which are to be administered to groups of three to five.

1. Rosewall-Chall Auditory Blending Test--The child's blending performance is assessed when the examiner presents the sound in a word slowly and the child tells him what the word is.
2. Bryant Phonics Test--students read the printed nonsense words which embody vowels and consonant combinations frequently encountered both in specific phonics teaching and in reading materials designed for early elementary grades.
3. Gates Advanced Primary Reading Tests, 1958--This test consists of a word recognition subtest, and a paragraph reading subtest.
4. Gray Oral Reading Test, 1963-67--Eight types of oral reading errors are measured. Thirteen reading selections comprise the test, each of

which is followed by four literal comprehension questions.

5. Fluency of Oral Reading--The measure of a child's fluency when reading aloud is the rate per second at which he reads correctly words in the first paragraph of the Gray Oral Reading Test.

6. Guessing at Words from Context--Each child is asked to read a list of six familiar words whose graphic and phonemic patterns diverge sharply. He is then provided with sentences in which the various key words are strongly implied by context. The more fluent readers read these sentences aloud. The material is read to children who cannot manage. All subjects are asked to guess at the key word in each sentence.

7. Written spelling Test (Metropolitan, Grade II)--The test is administered according to specifications given in the manual. The procedure tests spelling when it is given in response to dictation.

8. Oral Spelling Test (Stanford, Grades I and II)--The subjects are asked to spell fifteen words aloud.

9. Number of Letters Transposed (Metropolitan)--The number of times the child transposes letters in words from the Metropolitan Spelling Test is the child's score for this measure.

10. Number of letters Reversed (Metropolitan)--The number of letter reversals or inversions in writing the Metropolitan Spelling Test words is tallied.

11. Number of Words in Written Composition--The children are asked to write compositions about a cartoon sequence. The number of words used is the measure of composition length.

12. Percentage of Correctly Spelled Words in Composition--Of the total number of words in the written composition, the proportion spelled correctly is tabulated to get some idea of the child's

ability to spell correctly in context.

Hypotheses

The following statements are research, not null, hypotheses.

1. An expectancy circle which is larger than a child's achievement circle indicates an underachiever.
2. An expectancy circle which is equivalent in size to a child's achievement circle indicates a student who is working directly at his level of ability.
3. An expectancy circle which is smaller than a child's achievement circle indicates an overachiever.

Size, as described above, may refer either to physical dimensions or to numerical values.

Wechsler Intelligence Scale for Children
STEP-Listening 4A
Children's Manifest Anxiety Scale
Test Anxiety Scale for Children
Jackson-Hudgins Observation Scale
Gordon Self-Concept Inventory
National Opinion Research
Occupational Prestige Scale
Male-Female Designation

Rosewall-Chall Auditory Blending Test
Bryant Phonics Test
Gates Advanced Primary Reading Test, 1958
Fluency of Oral Reading
Guessing at Words from Context
Written Spelling Test
Number of Letters Transposed
Number of Letters Reversed
Number of Words in Written Composition
Percentage of Correctly Spelled Words in Composition
Gray Oral Reading Test, 1963-67

Expected Achievement

Actual Achievement

Expectancy Formula: Reading Achievement (Y) = B_1 (IQ) +B_2 (Listening Comprehension) +B_3 (Anxiety-Drive) +B_4 (Anxiety-Test) +B_5 (Attention) +B_6 (Self-Concept) +B_7 (Socioeconomic Status) +B_8 (Sex) +a (Constant)

BIBLIOGRAPHY

Alspaugh, John, and Burge, Paul, "Determination of Reading Expectancy," Journal of Experimental Education, 40 Summer, 1972, pp. 1-5.

Bond, Guy, and Clymer, Theodore, "Interrelationship of the S.R.A. Primary Mental Abilities, Other Mental Characteristics, and Reading Ability," Journal of Educational Research, October, 1955, pp. 131-136.

Bond, Guy, and Dykstra, Robert, Coordinating Center for First Grade Reading Instruction Programs, Final Report, U.S.O.E. Project number x-001, Minneapolis, Minnesota, University of Minnesota, 1967.

Bond, Guy, and Tinker, Miles, Reading Difficulties, Their Diagnosis and Correction, New York, Appleton-Century-Crofts, Inc., 1957, p. 79.

Buros, Oscar (Ed.), The Sixth Mental Measurements Yearbook, Gryphon, 1966.

Castaneda, Alfred, McCandless, Boyd, and Palermo, David, "The Children's Form of the Manifest Anxiety Scale," Child Development, September, 1956, pp. 317-326.

Chester, Robert, "The Psychology of Reading." The Journal of Educational Research, May-June, 1974, pp. 403-411.

Cleland, Donald, Causes of Reading Retardation, in A Report of the Ninth Annual Conference and Course on Reading, ed. by Gerald Yoakum, Pittsburgh, University of Pittsburgh Press, 1953.

Cleland, Donald, and Toussaint, Isabella, "The Interrelationship of Reading, Listening, Arithmetic Computation and Intelligence," Reading Teacher, January, 1962, pp. 228-231.

Denny, Douglas, "Relationship of Three Cognitive Style Dimensions to Elementary Reading Abilities," Journal of Educational Psychology, October, 1974, pp. 702-709.

Devito, Pasquale, Predicting Reading Vocabulary from Selected Variables, Rhode Island Department of Education, 1974.

Dore-Boyce, Kathleen, and Misner, Marilyn, and McGuire, Lorraine, "Comparing Reading Expectancy Formulas," The Reading Teacher, October, 1975, pp. 8-14.

Downing, Gertrude, The Preparation of Teachers for Schools in Culturally Deprived Neighborhoods, Final Report, Cooperative Research Project No. 935, Flushing, New York; Queens College, 1965, p. 304.

Durrell, Donald, and Sullivan, Helen, Reading Capacity and Achievement Tests Manual, New York, The World Book Company, 1945, p. 10.

Gates, Arthur, "Sex Differences in Reading Ability," Elementary School Journal, May, 1961, pp. 431-434.

Goodenough, Florence, "The Reading Tests of the Stanford Achievement Scale and other Variables," Journal of Educational Psychology, November, 1925, pp. 523-531.

Gordon, J., A Test Manual for the How I See Myself Scale, Florida Educational Research and Development Council, 1968.

Gray, William, In Harris, Chester (Ed.), Encyclopedia of Educational Research, third edition, MacMillan, 1960, pp. 1085-1135.

Grimes, J., and Allinsmith, W., "Compulsivity, Anxiety, and School Achievement," Merrill-Palmer Quarterly, October, 1961, pp.248-271.

Gunderson, Richard, and Feldt, D., "The Relationship of Differences Between Verbal and Non-Verbal Intelligence Scores to Achievement," Journal of Educational Psychology, June, 1960, pp. 115-121.

Hafner, Lawrence, Weaver, Wendell, and Powell, Kathryn, "Psychological and Perceptual Correlates of Reading Achievement Among Fourth Graders," Journal of Reading Behavior, Fall, 1970, pp. 281-290.

Harris, Albert, How to Increase Reading Ability, New York, David McKay Company, Inc., 1961, pp. 225-28, 298-302.

Harris, Albert, How to Increase Reading Ability, New York, David McKay Company, Inc., 1970, pp. 208-16.

Harris, Albert, and Sipay, Edward, How to Increase Reading Ability, New York, David McKay Company, Inc., 1975.

Harris, Theodore, "Reading," In Robert Ebel (Ed.) Encyclopedia of Educational Research, Fourth edition, MacMillan, 1969, pp. 1079-1104.

Heydenberk, Warren, A Comparison of Four Methods of Estimating Reading Potential, EdD Dissertation, University of Northern Colorado, 1971.

Hildreth, Gertrude, "An Individual Study in Word Recognition," Elementary School Journal, April, 1935, pp. 606-619.

Hilliard, George, Probable Types of Difficulties Underlying Low Scoresin Comprehension Tests, State University of Iowa, 1924.

Hodge, R., Siegel, P., and Rossi, P., "Occupational Prestige in the U.S. 1925-1963," In Bendix, R., and Lipset, S. (Eds.), Class, Status, and Power, second edition, New York, The Free Press, 1966.

Horn, Alice, The Uneven Distribution of the Effects of Specific Factors, Southern California Education Monographs Number 12, Los Angeles, California; University of Southern California Press, 1941.

Jackson, P., and Hudgins, B., Observation Schedule for Recording Pupil Attention, unpublished, 1965.

Jansky, Jeannette, and DeHirsch, Katrina, Preventing Reading Failure, New York, Harper and Row, 1972.

Jantz, Richard, "The Effects of Sex, Race, IQ, and SES on the Reading Scores of Sixth Graders for Both Levels and Gains in Performance," Psychology in the Schools, January, 1974, pp. 90-94.

Kim, Yung-Ho, "The Factor Structure of Social Maturity and Its Relation to Intelligence and Achievement," Dissertation Abstracts, 28,1968, 4002-A.

Lennon, Roger, "The Relation Between Intelligence and Achievement Test Results for a Group of Communities," Journal of Educational Psychology, May, 1950, pp. 301-308.

Loughlin, L., "An Investigation of Sex Differences by Intelligence, Subject-Matter Area, Grade, and Achievement Level on Three Anxiety Scales," Journal of Genetic Psychology, 106, 1965, pp.207-215.

Markert, Sandra, Relationships Between Listening Comprehension and Reading Comprehension Among Second Graders, M.Ed. Thesis, Rutgers University, 1974.

Marshall, Jon, and Powers, Jerry, Correlates of Achievement: Prediction and Cross-Validation for Intermediate Grade Levels, ERIC/CRIER ED064377, 1972.

McCarthy, D., "Some Possible Explanations of Sex Differences in Language Development and Disorders," Journal of Psychology, January, 1953, pp. 155-160.

McCarthy, D., "Language Development in Children," In L. Carmichael (Ed.), A Manual of Child Psychology, second edition, New York, Wiley, 1954.

McLeod, John, "Reading Expectancy from Disabled Learners," Journal of Learning Disabilities, February, 1968, pp. 97-105.

McLeod, John, "A comparison of WISC Subtest Scores of Pre-Adolescent Successful and Non-Successful Readers," Australian Journal of Psychology, 17:3, 1965, pp. 220-228.

Miller, Wallace, "Predicting Reading and Interpreting IQ Differences," Southern Journal of Educational Research, Winter, 1973, pp. 31-39.

Monroe, Marion, Children Who Cannot Read, Chicago, Illinois; The University of Chicago Press, 1932.

Moore T. "Language and Intelligence: A Longitudinal Study of the First Eight Years: Patterns of Development in Boys and Girls," Human Development, 10, 1960, pp. 88-106.

National Assessment of Educational Progress, Newsletter, Denver, N.A.E.P., June-July, 1972.

Reid, William, "Reading Achievement, Social Class, and Subset Pattern on the WISC," Journal of Educational Research, July-August, 1966, pp. 469-471.

Rodenborn, Leo, "Determining, Using Expectancy Formulas," The Reading Teacher, December, 1974, pp. 286-91.

Rohwer, W., "Learning, Race, and School Success," Review of Educational Research, 41, 1971, pp. 191-210.

Santostefano, Sebastino, Rutledge, L., and Rand, D., "Cognitive Styles and Reading Disability," Psychology in the Schools, 2, 1965, pp. 57-62.

Sarason, S., Davidson, K., Lighthall, F., and Waite, R., "A Test Anxiety Scale for Children," Child Development 29, 1958, pp. 105-113.

Scarborough, O., Hindsman, E., and Hanna, G., "Anxiety Level and Performance in School Subjects," Psychological Reports, October, 1961, pp. 425-430.

Schultz, Elizabeth, An Investigation of the Relationship between Individual Differences In Attention and Reading Achievement In First Grade, M. Ed. Thesis, Rutgers University, 1973.

Simmons, G.A., and Shapiro, B.J.,"Reading Expectancy Formulas: A Warning Note," Journal of Reading, 1968, 11, pp. 626-629.

Stanchfield, J., "Boys' Achievement in Beginning Reading," In J. Figurel (Ed.) Reading and Inquiry, Newark, Delaware, I.R.A., 1965.

Swarty, Darlene, The Relationship of Self-Esteem to Reading Performance, Ed.D. Dissertation, University of Northern Colorado, 1972.

Taylor, Janet, "Drive Theory and Manifest Anxiety," Psychological Bulletin,53:4, 1956, pp. 303-320.

Thorndike, Robert, The Concepts of Over and Under Achievement, New York, Teachers College Press, 1963,

Thorndike, Ed, and Gates, Arthur, Elementary Principles of Education, New York, MacMillan, 1929.

Torgerson, Theodore, and Adams, Georgia, Measurement and Evaluation, New York, The Dryden Press, 1954.

Triggs, F., Cartee, K., Binks, V.,Foster, D., and Adams, N., "Relationship between Specific and General Ability at the Elementary and Junior-Senior High School Levels," Educational and Psychological Measurement, 14:1, 1954, pp. 176-185.

Ullmann, C.A., "Prevalence of Reading Disabilities as a Function of the Measure Used," Journal of Learning Disabilities, 1969, 2(11), pp. 556-558.

Vernon, P.E., "The Relation of Intelligence to Educational Backwardness," Education Review, 1958, 9, pp. 7-15.

Wilson, Robert, Diagnosis and Remedial Reading for Classroom and Clinic, Columbus, Ohio; Merrill, 1967, p. 35.

Wozencraft, Marion, "Sex Comparisons of Certain Abilities," Journal of Educational Research, 57, 1963, pp. 21-27.

Young, William, "The Relation of Reading Comprehension and Retention to Hearing Comprehension and Retention," Journal of Experimental Education, September, 1936, pp. 30-39.

Zeman, Sam, "Reading Comprehension and Writing of Second and Third Graders," Reading Teacher, November, 1969, pp. 144-150.